



Artisan iris-claw intraocular lens implantation in vitrectomised eyes

Guy S. Negretti¹ · Weng Onn Chan¹ · Mahiul M. K. Muqit¹

Received: 9 November 2019 / Revised: 3 June 2020 / Accepted: 4 June 2020 / Published online: 18 June 2020
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Abstract

Objectives To present the visual acuity (VA) results and complication rates following Artisan intraocular lens (IOL) insertion in vitrectomised eyes.

Methods Outcome data were collected for all vitrectomised patients who had undergone Artisan IOL insertion between January 2014 and May 2019 at Moorfields Eye Hospital. All those with follow-up greater than 2 months were included in the analysis.

Results Sixty-nine eyes from 61 patients were included. Average follow up was 2 years. Fifty-five (80%) eyes had at least one ocular comorbidity prior to Artisan IOL insertion. At final follow up 46 (67%) eyes had best-corrected VA better than 6/12. Sixty-three eyes (91%) either gained or maintained VA. Mean post-operative spherical equivalent was $-0.2D$. Two (3%) lenses became de-enclavated requiring further surgery. Two (3%) eyes developed acute post-operative cystoid macular oedema. Two (3%) required additional topical IOP-lowering therapy to their pre-operative glaucoma regimen. One eye had mild corneal oedema, which persisted for 1 year following surgery and subsequently resolved.

Conclusions Artisan IOL insertion is a safe and effective option for the surgical correction of aphakia in vitrectomised eyes lacking capsular support. Refractive results comparable to posterior chamber IOL placement can be achieved with these lenses.

Introduction

There are three strategies for intraocular lens insertion in vitrectomised eyes without adequate capsular support: angle-supported, scleral fixated or iris-fixated intraocular lenses (IOLs). Non-randomised studies, not specifically in vitrectomised eyes, have attempted to compare these alternatives [1]. In the absence of randomised control trial evidence there remains no consensus as to which is the best option.

Some of the first iris-fixated lenses were introduced by Worst et al. [2]. These were subsequently modified to become the Artisan IOL (Ophtec, Groningen, The Netherlands). Since the introduction of the Artisan IOL several studies have demonstrated the efficacy and safety of its use in patients without capsular support [1, 3–6]. Studies, looking specifically in vitrectomised patients tend to have had small sample sizes with short follow up [7–9].

We present the results from a large cohort of vitrectomised patients who underwent Artisan IOL insertion. The results of this study will enable practitioners to make a more informed choice as to what IOL to use in these complex eyes, which often have multiple other comorbidities.

Methods

This was a single centre retrospective case series study. We included all vitrectomised patients who underwent Artisan IOL insertion over a 5-year period between January 2014 and May 2019 at Moorfields Eye Hospital. Cases were identified using our electronic patient record with external validation using medical records. Patients with <2 months of follow up were excluded from our analysis as were patients with a history of uveitis, outcomes from whom have been reported elsewhere [10]. The study was approved by the Institutional Review Board at Moorfields Eye Hospital (CA18/VR/114). The study adhered to the tenets of the Declaration of Helsinki.

The surgical technique involved a 5.5 mm clear corneal incision with closure of the wound with 10/0 nylon. An intracameral acetylcholine chloride (Miochol) injection was

✉ Mahiul M. K. Muqit
Mahi.Muqit1@nhs.net

¹ Vitreoretinal Service, Moorfields Eye Hospital, City Road, London EC1V 2PD, UK

used to maintain a constricted pupil, and a customised Artisan implantation forceps used to stabilise the Artisan IOL in the anterior chamber. Two 20-gauge paracentesis incisions were made in line with the two iris enclavation locations, and the Vacufix (Artisan, Ophtec, Groningen, The Netherlands) system used to enclavate the peripheral iris, in a controlled vacuum-assisted step, to the Artisan IOL haptics. Where possible the Artisan IOL was enclaved anterior to the iris. A peripheral surgical iridotomy was created at the time if not already present. Prior to listing patients for surgery, particularly in patients who had undergone previous complicated cataract surgery, eyes had to be non-inflamed with normal intraocular pressures and clear corneas.

Pre-operatively, optical biometry was performed where possible, with A-constants of 115.7 for anterior-placed lenses and 116.7 for posterior-placed lenses. The SRK-T formula was used for all eyes with axial lengths greater than 22 mm and the Hoffer Q for those <22 mm.

Statistical analysis

Statistical analysis was conducted using IBM SPSS Statistics (Windows Version 24.0, release 2016; IBM, Armonk, NY) for descriptive and numerical statistical comparisons. The VA was converted from Snellen to LogMAR for analysis. Snellen counting fingers at 1 m vision was converted to 1.87 LogMAR, Snellen hand motions vision to 2.3 LogMAR, perception of light (PL) to 2.8 LogMAR and non-perception of light (NPL) was 3.0 LogMAR. Means were compared with student *T*-tests. All cases with follow-up greater than 2 months were included in the analysis, there were no cases excluded. A *p* value < 0.05 was considered statistically significant.

Results

Sixty-nine eyes of 61 patients underwent Artisan lens insertion between January 2014 and October 2018. This included 21 females and 40 males with an average age of 66 years (SD 18.1). Average follow up was 2 years (range: 2 months–4.75 years).

Twenty-six eyes were already vitrectomised prior to Artisan insertion with an average time between initial vitrectomy and Artisan IOL insertion of 3.3 years (range: 21 days–15 years). Forty-three eyes underwent vitrectomy at the time of Artisan IOL insertion to assist with the removal of lenses dislocated or subluxated within the posterior vitreous. The Artisan IOL was enclaved anterior to the iris in all eyes apart from one in whom the Artisan was placed posteriorly due to iris atrophy.

Indications for Artisan IOL insertion are shown in Table 1. Seven (50%) of the eyes with a history of subluxed

Table 1 Indications for Artisan insertion.

Indication for Artisan IOL	N (%)
Aphakic following complicated cataract surgery	19 (28%)
Subluxed/Dislocated IOL	33 (48%)
Subluxed Crystalline Lens	14 (20%)
Phacodonesis	3 (4%)

Table 2 Pre-existing ocular comorbidities.

Co-morbidity	Number of eyes
Amblyopia	3
Age-related macular degeneration	5
Aqueous misdirection	1
BRVO/CRVO	4
Epi-retinal membrane	2
Glaucoma	12
High myopia	3
Homocystinuria	1
Marfan's Syndrome	7
PDR/Previous diabetic delamination surgery	2
Previous endophthalmitis	1
Previous macular surgery	4
Pseudoexfoliation syndrome	6
Retinal detachment surgery	16
Ocular trauma	5
Stickler's/Kneist Syndrome	1

AMD age-related macular degeneration, *BRVO* branch retinal vein occlusion, *CRVO* central retinal vein occlusion, *PDR* proliferative diabetic retinopathy.

crystalline lenses had a history of Marfan's syndrome. Of those eyes with subluxed or dislocated IOLs, the average time between their initial cataract surgery and the Artisan insertion was 13 years (Range: 22 days–21 years). Seven (21%) of these eye's initial cataract surgery was complicated with one having had post-operative endophthalmitis, three had posterior capsular rupture, four had zonular dehiscence noted at the time of cataract surgery, one had a fractured IOL haptic at the time of surgery and one had an anterior capsular tear.

Pre-existing co-morbidities were common in this group of patients as shown in Table 2. Fifty-five (80%) eyes had at least one ocular comorbidity prior to Artisan IOL insertion. Fourteen (20%) of these had two ocular comorbidities and four (6%) had three.

As shown in Fig. 1, average best recorded pre-operative visual acuity, prior to Artisan placement, was 0.98 LogMar (6/60). At 2 weeks it was 0.46 LogMar (6/18) and at most recent follow up it measured 0.25 LogMar (6/12). This was a statistically significant improvement from pre-operatively

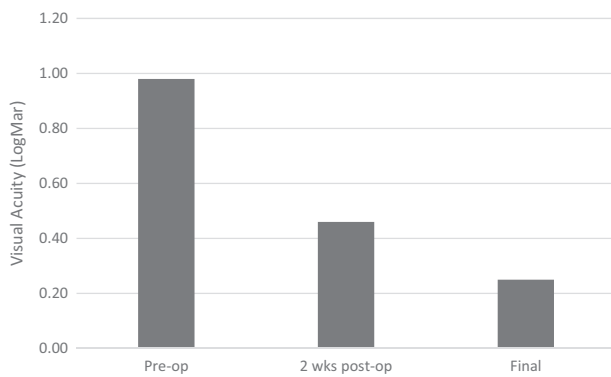


Fig. 1 Visual acuity results of artisan lens implantation over time. A graph showing average visual acuity (LogMar), pre-operatively, 2 weeks post-operatively and at final follow up.

to final follow up (paired *T*-test, $p < 0.001$). Pre-operatively, 13 (19%) eyes had BCVA better than 6/12. Post-operatively, 46 (67%) eyes had BCVA better than 6/12. Sixty-three eyes (91%) either gained or maintained visual acuity following their Artisan insertion. Reasons for the six eye's worsening vision included: cerebral glioblastoma, age-related macular degeneration ($n = 2$), branch retinal vein occlusion, glaucoma and central retinal vein occlusion.

For those 46 (67%) eyes with greater than 1 year follow up, average BCVA pre-operatively was 0.9 LogMar (6/60). At 2 weeks it was 0.5 LogMar (6/18) and at most recent follow up it measured 0.3 LogMar (6/12). This was a statistically significant improvement from pre-operatively to final follow up (paired *T*-test, $p < 0.001$).

Complications

Intraoperative complications were rare. Two eyes had iris trauma at the time of Artisan insertion. One eye had a small suprachoroidal haemorrhage, which resolved and the eye achieved 6/6 vision.

Average intraocular pressure prior to Artisan insertion was 16.46 mmHg (SD 6). At 2 weeks it was 16.82 mmHg (SD 6) and at final follow up it was 14.49 mmHg (SD 4). This was a significant reduction in IOP between the pre-op and final follow up visit (paired *T*-test, $p < 0.01$). One eye developed raised intraocular pressure that eventually required Baerveldt tube insertion. This eye had previously had aqueous misdirection following combined macular hole and cataract surgery prior to being considered for Artisan insertion. At final follow up 2 further pre-existing glaucoma-affected eyes required additional IOP-lowering therapy (topical Latanoprost) to what they were using pre-operatively for glaucoma. At the two-week post-operative visit, two eyes were started on a short course of G. Dorzolamide/Timolol to treat a steroid-response raised IOP. They were not using this at final follow up.

Two (3%) lenses became de-enclavated. Each needed one further uncomplicated operation to re-enclavate the lens; one 3 months after the initial surgery and one 2.5 years following the initial surgery. Neither of these eyes demonstrated corneal oedema or decompensation associated with the de-enclavation and further surgery; one recovered visual acuity to 6/6 and the other 6/9. Two (3%) eyes developed post-operative cystoid macular oedema. This resolved in both cases with a six-week course of topical Dexamethasone and Ketorolac.

Other complications included one eye that developed a sterile endophthalmitis post-operatively. The eye underwent a tap and inject procedure 6 weeks following Artisan insertion. This demonstrated no organismal growth. This eye achieved 6/9 vision at most recent follow up with an epiretinal membrane thought to be limiting further visual improvement. One eye had a retained lens fragment in its anterior chamber, which required a washout. One eye had mild corneal oedema, which persisted for 1 year following surgery and then subsequently resolved. Distorted pupils were not observed in this series, and pupil reactions remained normal in all eyes after Artisan implantation.

Refractive results

Pre-operative refraction was available for 49 eyes. Mean pre-operative spherical equivalent was $-0.79D$ (SD 6.5) and the mean pre-operative cylinder was 1.7D (SD 1.2). The mean power of Artisan IOL inserted was 17D and the mean target refraction was $-0.3D$. Post-operative refraction was available for 54 eyes. Mean post-operative spherical equivalent was $-0.2D$ (SD 0.8). Mean post-operative cylinder was 1.4 D (SD 1.2). Forty-five out of the 54 eyes (83%) had a post-operative spherical equivalent within 1 D of their target refraction and 30 out of 54 eyes (56%) had a post-operative spherical equivalent within 0.5D.

Discussion

This case series is unique in that it presents the results of Artisan IOL insertion in a large cohort of vitrectomised eyes many of which (80%) had pre-existing comorbidities that could have adversely affected outcome. Despite this, our results compare favourably in terms of visual acuity, complication rates and refractive outcomes to other studies not carried out in vitrectomised eyes with fewer pre-existing comorbidities. For example, two of the largest of these studies to date included 128 and 116 eyes with average follow up of 42 months and 22 months [4, 5]. They noted 45% and 69% of patients achieving BCVA $> 6/12$, respectively. This compares to our figure of 67% achieving BCVA $> 6/12$.

The average difference between target refraction and final refraction in our series was 0.1D and the average post-operative spherical equivalent was $-0.2D$ with no significant astigmatism induced. These results compare favourably to previous studies [4–6, 9] and reinforce the idea that with Artisan IOL insertion we should be expecting to achieve refractive results comparable to posterior chamber IOL placement.

A limitation of this study is the relatively short average follow up time of 2 years. It is reassuring that in those of patients with follow up greater than 1 year (67%), outcomes were no different to those <1 year. This suggests that outcomes are not likely to worsen with time. Some authors, however, express concern regarding endothelial cell counts over the long-term [11, 12] and cases of corneal decompensation following Artisan Lens insertion have been reported [13, 14]. Although we have not yet seen any cases of corneal decompensation we plan to follow up our patients closely observing for any corneal decompensation with time.

In addition to Artisan IOLs our results also compare favourably to studies looking at anterior chamber IOL (ACIOL) and scleral-fixated IOLs [15–17]. A large study looking at ACIOL outcomes in a similar population to ours demonstrated 92% of eyes maintaining or gaining VA compared to our 91% [15]. Complications, however, were more common with the ACIOLs with 15% of patients developing CMO, 6% developing corneal decompensation and 6% having lens displacement or instability requiring further surgery.

The favourable outcomes that we achieve with Artisan IOL insertion in vitrectomised eyes are reassuring and help add clarity to the controversial question of which IOL to use in eyes lacking adequate capsular support. However, we think a randomised controlled study comparing the alternatives is still required to further aid the surgeon in this complex subject-area.

Summary

What was known before

- Controversy still remains regarding the best intraocular lens to use in eyes lacking capsular support. - Promising results from Artisan intraocular lens insertion have been published.

What this study adds

- This is the first study looking at Artisan lens insertion in vitrectomised eyes. - It shows that even in these eyes

with multiple sight-threatening comorbidities good visual acuity and refractive results can be achieved with a low complication rate.

Acknowledgements Support from the NIHR London Biomedical Research Centre is acknowledged. We would like to thank the following Moorfields Vitreoretinal Fellows who contributed to the care of these patients: M. Kadhim, O. Comyn, P. Tyagi, Y. Luo, S. Aslam, S. Abou-Ltaif and M. Mehat.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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